

# FOUNDATIONS OF NEUROSCIENCE

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# Acknowledgments

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# Introduction

*Spring snow lingers on the Chung-nan mountains,  
lovely in the blue distance.  
A thousand coaches, ten thousand horsemen  
crowd the dusty roads of Chang-an.  
But not one turns and looks at the mountains.*

Po Chü-i (772–846 A.D.)

I began this work as an attempt to think through neuroscience from the foundations, to arrive at a new understanding, leaving no assumptions unquestioned. The “known” facts kept striking me as less and less explained by the old reasons. New reasons are wanted, but I found that reasoning anew about facts that everybody “knows” is as difficult as discovering what no one yet knows. The known facts are necessary but insufficient. To know a fact we must understand how it is represented in a theory, and also know the probability of its existence as an object in itself. That requires the use of a critical apparatus which this work aims to provide.

Inevitably, necessarily, different people will have different theoretical concepts and will select different facts to support their theories. Our theories are only guesses at the truth. Even when theories are brought into consilience with facts, they remain incomplete representations of reality. They may be brought into successively closer approximations to reality by enlarging the base of facts on which they stand, and by a process of unremitting critique to detect new relationships and eliminate anomalies. We are good at inventing methods for making new observations, but we are less competent at exercising critique. Such a critical method is necessary to explain how our observations are related to theories and how theories lead to successful predictions of new observations. For those purposes, knowledge of the history and philosophy of neuroscience is indispensable.

I regard knowledge of the history and philosophy of science as the memory and consciousness of science. Just as consciousness and memory give us identities as human beings, our knowledge of history and philosophy of science give us identities as scientists. But histories of science are also incomplete and distorted representations of reality. This limits our ability to compare our versions of the past with the present. Historical accounts are highly selective; they present a past that is rearranged and tidied up and thus that seems to be quite unlike the messy and disorderly present. The

truth is that the past two centuries, during which neuroscience has evolved rapidly, are quite similar to the present—disorganized, uncertain, and hard to explain.

The worst sort of history deals mainly with outstanding figures, with heroes, and sometimes with antiheroes. That sort of history makes us feel that we have come after the golden age, or at best, that we are located at the end of the truly creative age. That is nonsense, and it is also mischievous because it makes the present seem mediocre by comparison with the past. Many ask: Where are there heroes like Cajal today? We cannot find them because such heroes never really existed—they are fictions in the minds of the hero-worshippers.

These problems are not confined to the history of science but also infect histories of the arts, philosophy, ethics, religion, and politics. Much more than those histories, we must understand the history of science if we want to understand mankind. That understanding is preeminently necessary because only scientific knowledge is truly cumulative and progressive. I argue that a condition for the continued progress of science is that we understand the relations between theories and data, and how our values affect our perceptions of the best uses of scientific knowledge. My intention is to provide some materials for competent critique that can be used to advance our science to goals that are not only useful, but also just and humane.

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